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**Technical  
Memorandum  
C12660**

**Receptor/Pathway Analysis  
Pagel's Pit Landfill  
Rockford, Illinois**

Prepared for:  
**Pagel's Pit Landfill  
PRP Steering Committee  
Rockford, Illinois**

Prepared by:  
**Warzyn Engineering Inc.  
Madison, Wisconsin**

November, 1986



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Rockford, Illinois**

November, 1986

# WARZYN



Engineers & Scientists  
Environmental Services  
Waste Management  
Water Resources  
Site Development  
Special Structures  
Geotechnical Analysis

November 24, 1986  
C 12660

Mr. David Favero  
U.S. EPA Region 5  
Hazardous Waste Enforcement (5HE-12)  
230 S. Dearborn Street  
Chicago, IL 60604

Dear Mr. Favero:

Attached are five copies of the Receptor/Pathway Analysis for Pagel's Pit Landfill RI/FS. This technical memorandum is submitted in accordance with our draft project schedule.

If you have any questions or comments regarding the report, please contact us.

Sincerely,

WARZYN ENGINEERING INC.

Daniel W. Hall, CPGS  
Project Manager

DWH/jpl/BAW  
[jpl-18-2]

Enclosures: As Stated

cc: Mr. Gary Marzorati, Winnebago Reclamation Service, Rockford, IL (w/encls)  
Mr. John Holmstrom, Holmstrom, & Green Rockford, IL (w/encls)  
Mr. Chuck Howard, Winnebago Reclamation Services, Rockford, IL (w/encls)  
Mr. Ridgway Hall, Crowell & Moring, Washington, D.C. (w/encls)  
Mr. Thomas Tullock, City of Rockford, Rockford, IL (w/encls)  
Mr. Richard Eick, Sanitary District of Rockford, Rockford, IL (w/encls)

RECEPTOR/PATHWAY ANALYSIS  
PAGEL'S PIT LANDFILL

INTRODUCTION

The Pagel's Pit Landfill (also known as Winnebago Reclamation Landfill) is located about 5 miles south of Rockford, Illinois (See Drawing 12660-B1). The landfill facility, which occupies approximately 60 acres, is a former sand and gravel pit and dolomite quarry that has been licensed and operated as a landfill by Winnebago Reclamation since 1972. Records indicate that wastes accepted at the site are primarily mixed municipal refuse and sewage treatment sludge. A limited quantity of special wastes were disposed at the facility prior to December 1975.

Purpose

The purpose of this analysis is to identify and evaluate potential pathways and receptors of contaminants using available information from investigations at Pagel's Pit Landfill and the adjacent ACME Solvents Site. The potential contaminant migration pathways and associated receptors identified during this analysis will be investigated further during the RI/FS for Pagel's Pit Landfill. The pathways and receptors can then be evaluated to establish remedial action goals and alternatives consistent with the National Contingency Plan. Preliminary identification of potential remedial action alternatives is also included in this memorandum.

The information that was reviewed and considered in this analysis includes the following reports:

- "Supplemental Investigation, Winnebago Reclamation Landfill, Rockford, Illinois", Warzyn Engineering, Inc. (WEI), March, 1985
- "Extent of Sources of Groundwater Contamination - ACME Solvents, Pagel Pit area near Morristown, Illinois", Ecology and Environment, Inc. (E & E), March, 1983
- "ACME Solvents Superfund Site, Winnebago County, Illinois, Remedial Investigation", E.C. Jordan Company, September, 1984
- "Data Analysis and Summary Report for Deep Groundwater Assessment, ACME Solvents Superfund Site", E.C. Jordan, January, 1986.

In addition to these reports, the Hazard Ranking System (HRS) score sheet for Pagel's Pit Landfill, private well water quality data, and site related correspondence were also considered. At this time, it is not known what impact the surface cleanup of the Acme facility will have on the area. The action constitutes a removal of a portion of the contamination originating from Acme (residual contamination still occurs at depths beneath Acme). The removal action will have a beneficial impact, but to what degree and in what time frame is unclear.

Potential contaminant pathways that were identified using available data, and are considered in this analysis include:

- Groundwater
- Surface Water and Sediment
- Air

## PATHWAY/RECEPTOR ANALYSIS

A. Groundwater1. Pathways

In the area around the Pagel's Pit Landfill, the following groundwater aquifers can be differentiated:

- Sand and Gravel - Sands and gravels capable of providing significant quantities of groundwater, particularly in filled bedrock troughs and valleys associated with the Rock River.
- Galena, Decorah and Platteville Dolomite - These fractured bedrock units are relatively shallow and are capable of supplying small to moderate yields. These formations are used principally for domestic water supply.
- Basal portions of the Glenwood Formation and underlying St. Peter Sandstone - These units comprise a regionally extensive aquifer capable of supplying up to 300 gpm.
- Cambrian Formation - These aquifers are 1,500 to 2,000 feet thick and are capable of supplying large yields of high quality water.

The thickness of the unconsolidated materials at the site ranges from approximately eight feet at Boring B-16A, located east of Lindenwood Road, to greater than 40 feet at Boring G-107, north of the landfill (See Drawing C 12660-B4 for boring locations). A transition from clay and silt soils (glacial till) to sand and/or sand and gravel soils occurs just south of the Pagel's Pit Landfill and follows an east-west orientation.

Dolomite bedrock underlies the unconsolidated deposits at the site. The bedrock surface forms a high which is oriented roughly southwest to northeast. The bedrock surface dips to the northwest and southeast. Pagel's Pit Landfill is located on the margin of the area where the bedrock surface starts to dip sharply to the northwest.

Based on bedrock cores, the integrity of the dolomite varies considerably. Numerous horizontal fractures were noted with large vuggy zones. Vertical fractures were also occasionally encountered. Water losses while coring indicate the fractures and vuggy zones provide relatively high permeability zones within the bedrock.

The water table is within the dolomite bedrock in the area extending from the ACME facility to the central portion of the Pagel's Pit Landfill. Because the bedrock surface dips to the west and south and the thickness of the unconsolidated deposits increases, the water table is found in the clay till subsoils in areas south of the landfill, and in sand and/or sand and gravel soils in the western and northern portions of the site. Water level monitoring data collected to date indicates that horizontal groundwater flow moves radially outward away from a groundwater high near Monitoring Well B-4 at the ACME Solvent site. The predominant flow direction away from B-4 is west toward the Pagel's Pit Landfill with components of flow to the north and south. Vertical hydraulic gradients calculated at nested monitoring well locations are variable and are summarized below:

- MW-105/B-6S/B-6D - generally a slight upward gradient. The proximity of these wells to the intermittent waterway between the ACME site and the landfill results in occasional reversal of the gradient due to recharge of the aquifer in areas where the waterway traverses a bedrock outcrop.
- Nests B-10/B-10A and G-109/G-109A - Nests with both wells installed in bedrock were observed to have consistent upward gradients.
- P-3/-P-4/P-5 - Consistent slight upward gradients from the dolomite to the sand and gravel aquifer.
- B-11/B-11A - Consistent downward gradients. Both wells are installed in the bedrock aquifer.
- B-13/P-6 - Generally downward gradient.



- P-1/MW-106 - Installed adjacent to Killbuck Creek. Shows alternating upward and downward gradients. Gradient reversals may indicate that Killbuck Creek switches from being a groundwater discharge point during low creek flow to a recharge source during high flow.

A review of water quality data indicates that slightly elevated levels of arsenic, barium and phenols were found at a few wells downgradient of or adjacent to the landfill. Somewhat elevated levels of conductivity, chloride and alkalinity were also detected at the margins or downgradient of the site. Volatile organic compounds were also detected in wells sampled. The Pagel site will be evaluated during the RI for possible release of inorganic and organic compounds.

Contaminants that may potentially leak from the landfill and enter the groundwater flow system will likely migrate to the west and northwest. The upward gradient from the bedrock aquifer to the sand and gravel aquifer may preclude the migration of contaminants from the landfill into the bedrock and perhaps from traveling beyond Killbuck Creek, the local groundwater discharge point. Because of the landfill's location adjacent to Killbuck Creek, the impact to the deeper aquifer (Glenwood and Cambrian formations) is less likely than that on the sand and gravel and dolomite aquifers. Generally, the greater the distance from the river, the greater the potential for deeper migration of contaminants into the groundwater flow system.

Contaminants from the ACME facility are known to be present in the glacial and bedrock aquifers due to downward migration of contaminants at the ACME site. Subsequent westerly migration of contaminants from the ACME facility in the glacial and bedrock flow systems will be delineated in the RI/FS. Unless significant mounding is occurring within the landfill which effects

radial flow of contaminants from the site, all upgradient (east) water quality impacts can generally be attributed to upgradient sources. Differentiation of these upgradient sources from any impact due to the landfill will be a focus of the RI.

The potential extent of contaminant migration in the groundwater downgradient of Pagel's Pit Landfill cannot be determined with available data. Killbuck Creek does not fully penetrate the shallow sand and gravel aquifer, so the potential for underflow to the west is possible. The potential for contaminant migration beneath the creek also exists for contaminants that are already established deep in the groundwater flow system, such as the volatile organic contamination which originates beneath the ACME facility.

## 2. Receptors

Potential receptors of contaminants within the local groundwater systems include:

- private well owners in the vicinity of the site,
- surface water bodies which receive groundwater discharge, and
- the potential users of the surface water to which the groundwater discharges.

The private wells in the vicinity of the landfill typically draw water from the sand and gravel aquifer or the Galena dolomite. Approximately 15 to 20 residences are located within 1.5 miles of the landfill in the downgradient direction (west and north). Groundwater use and the aquifers being utilized has not been determined for these residences. Although the potential for contaminant migration beneath Killbuck Creek exists, the assimilative capacity

of the aquifer may likely result in minimal or nondetectable impacts to water quality in wells downgradient. The nearest downgradient private well is more than a 1/4 mile away in a marginally downgradient direction. Water quality samples from this well will be tested during the RI groundwater monitoring program.

The private wells located along Lindenwood Road that have been affected are upgradient from the landfill and downgradient from the ACME Solvents facility. Owners of these wells are supplied with bottled water and no longer use the wells for personal consumption. The RI Work Plan includes installation of monitoring wells between the landfill and the affected private wells.

The HRS score sheet indicates that the population served by private wells that are potentially affected by site-derived contamination is approximately 4841. The population served includes residents and other individuals within a 3-mile radius of the landfill, who regularly use the groundwater from the aquifer of concern for drinking purposes. However, the HRS does not take into consideration the flow direction and hydraulic gradient when determining the target population. Thus, the actual number of receptors is expected to be far less than 4841.

Chemical analyses by Illinois Environmental Protection Agency (IEPA) of samples collected from a stream bank spring which enters Killbuck Creek approximately 200 feet west of the landfill indicate that the creek is a receptor of volatile organic contaminants from a shallow groundwater source

to the east. Flora and fauna utilizing the creek as a water source may thus be indirectly affected by groundwater contamination. These surface waters are not used for consumptive purposes by humans.

## B. Surface Water and Sediments

### 1. Pathways

The primary surface drainage feature in the vicinity of Pagel's Pit Landfill in Killbuck Creek, which is less than 300 feet from the landfill at it's closest point. Killbuck Creek flows to the northwest and converges with the Kishwaukee River (approximately 2 miles downstream) and the Rock River (approximately 2.5 miles downstream). Several intermittent drainageways flowing generally east to west discharge to Killbuck Creek. Surface water sampling in the vicinity of the Pagel's Pit Landfill has been limited to the intermittent creek between the ACME Solvents and Pagel sites, and a streambank spring which discharges into Killbuck Creek approximately 200 feet west of the landfill. Analyses of these samples do not indicate the presence of surface water contamination in the intermittent creek; however, volatile organic compounds were detected in the sample collected from the streambank spring. Samples have not been collected from Killbuck Creek to determine potential landfill impacts on surface water quality in the creek.

Although it has not been established whether Killbuck Creek has been affected by the landfill site, the potential for surface water quality degradation does exist. Leachate seeps and runoff from exposed contaminated materials may impact surface water quality in the area. Discharge of contaminated groundwater to Killbuck Creek may also impact surface water quality, if the landfill is a source of groundwater contamination.



The intermittent creek which is located between the ACME and Pagel facilities, and which flows west toward Killbuck Creek north of the landfill, is not considered an important pathway. The creekbed is dry most of the year, and groundwater apparently does not discharge to it, limiting its capacity in the role of transmitter or receptor of contaminants.

Because of the controlled nature of the landfill site, transport of contaminated sediments between the site and surface water bodies is not considered an important aspect of the RI, however, the potential does exist. It is possible that sediments may be carried with overland runoff during precipitation events or within moving surface water bodies. Contaminated sediments could in this manner become deposited in low lying areas between the landfill and Killbuck Creek and could become deposited in the creekbed. Contaminated sediments deposited in the creekbed may have an effect on surface water and groundwater quality.

## 2. Receptors

Analyses of samples collected by IEPA and U.S. EPA Region V FIT from a stream-bank spring indicate that Killbuck Creek is a receptor of volatile organic organic contaminants (source not defined). As stated above, because of the controlled nature of the landfill site, a direct contaminant pathway via surface water runoff (overland flow) is not considered an important aspect of the RI.

Flora and fauna in Killbuck Creek may potentially be impacted by discharge of contaminated groundwater through creek sediments into the surface water.

Long term effects, such as bio-accumulation of contaminants may result in food chain accumulation in plants and animals that contact this water.

Because of the relatively low levels of inorganic constituents of concern measured to date in groundwater samples collected at site (As, Ba, Cd), and the nature of volatile organics, the impacts to Killbuck Creek are probably minimal from Pagel's Pit Landfill.

### C. Air

#### 1. Pathways

Although there is no documented evidence of air quality problems in the vicinity of the Pagel's Pit Landfill, the possibility of volatiles being present in waste materials and soils creates the potential for releases of volatile gases with both toxic and aesthetic concern. Direct and indirect contact for humans, animals and vegetation is possible. Because of the controlled nature of the landfill, direct contact by humans is expected to be low, except perhaps for site workers. Even municipal refuse contains a certain amount of volatile constituents, such as paints, thinners, alcohols, etc. These volatiles have the potential to de-gas from the site and migrate in the prevailing wind direction. Because of the known source of volatile contaminants at the ACME facility, the ACME facility may be causing emission of volatile organics to the air. Care will have to be taken during air monitoring at the site during the RI to differentiate potential sources of volatile emission.

In addition to volatile gases, airborne dust from contaminated soil may result in direct contact. Indirect contact may result from use of surface



water bodies that have been adversely impacted by deposition of contaminated dust particles.

Migration of landfill gases in the subsurface has been documented in the past. Homes east of the landfill along Lindenwood Road were being affected by the gas migration. A gas migration control/collection system was installed at the landfill and the problem was alleviated.

## 2. Receptors

Potential receptors of airborne contaminants include humans, animals and vegetation that are located downwind at the time of release of volatile gases. The rapid dispersion of volatile gases in the air and the susceptibility of volatiles to photo-oxidation will likely result in minimal impact, if any, at the site.

Potential receptors of landfill gas migration in the subsurface include humans and animals living in the vicinity of the landfill. Vegetation may also be impacted by gas migration. As stated previously, the gas migration control/collection system installed at the landfill should limit subsurface migration of landfill gas.

## IDENTIFICATION OF POTENTIAL REMEDIAL ACTION ALTERNATIVES

If Pagel's Pit Landfill is found to be a source of a release of hazardous waste meriting remedial action, the following potential remedial alternatives may be evaluated for establishing source control and migration management.



### A. Source Control

1. More efficient cover system. The landfill is presently an active site and the cover system is not complete. Normal closure procedures will include placement of a low permeability clay cover over the top of the fill to minimize infiltration of precipitation. Use of a synthetic cover or a multi-layer cover may be considered to further reduce infiltration.
2. Gas Control. The landfill gas collection system is already in operation at the site. Presently, gas is collected, cleaned and used for drying of municipal sewage sludge before deposition into the landfill. Further, gas will be furnished over the long term to nearby industrial users under contract, after site closure. The efficiency of the gas collection system may be evaluated.
3. Leachate Reduction. Leachate is presently being pumped from the landfill, collected and treated. After completion of the landfill cover, infiltration and leachate generation should be minimized. Reduction of leachate levels below present conditions may be a feasible source control alternative, if the effectiveness of the liner is shown to be a problem.
4. Barrier Wall. A barrier wall system such as a clay cutoff or slurry trench around the landfill to prevent contaminant migration through the groundwater from the landfill will be evaluated. This alternative, by itself, may be of limited value due to the lack of an impermeable stratum that the wall could be keyed into. In combination with a pumping and treating system, this alternative may be more feasible.
5. Groundwater Pumping Barrier. Development of a barrier to contaminant migration may be possible using a groundwater pumping scheme. This alternative involves developing a groundwater pumping system which would effectively control the groundwater gradient and prevent contaminant migration from the source.  
  
The groundwater would be collected and treated before eventual discharge. This alternative may be evaluated on its own merit and in combination with a barrier wall system.
6. Enhanced Volatilization. If volatile organic compounds are determined to be a problem within the landfill, this alternative may be considered to remove the volatiles with the landfill gas, so as to reduce the concentration of volatiles in the leachate.
7. Excavation. If the landfill is determined to be a source of contamination, partial or complete excavation with subsequent waste disposal or incineration will be evaluated. Although this is an alternative that will be considered, the volume of waste disposed at the site will be a limiting factor on the cost efficiency and feasibility of this alternative.

8. Movement of Waste. If waste must be excavated to remediate a site problem, a new landfill area may be upgraded to RCRA requirements to accept the waste. This would depend on the availability of landfill space, permitting, timing and other factors.
9. No Action. The consequences of the no action alternative will be evaluated.

#### B. Migration Control

1. Groundwater Barrier System. A groundwater barrier system (pumping or barrier wall) as described under Source Control could also serve as a tool to limit migration of contaminants at the margin or downgradient of the site.
2. Creek Sediment Removal. If sediment sampling in Killbuck Creek indicates the presence of contaminants, removal of creek bed sediments to control further contaminant migration may be considered.
3. Improved Site Drainage. In order to reduce the potential for contaminant migration in surface water runoff, the site drainage system can be improved. Placement of the final cover will limit surface water contact with waste.

Vegetating the landfill cover will also help to minimize sediment erosion. Development of a sedimentation basin will reduce sediment loading to surface water bodies. Site drainage control alternatives may be further evaluated during the feasibility study.

4. Gas Migration Control. This system is already in place as discussed in Source Control.
5. No Action

RJK/jpl/BAW  
[jpl-18-1]

# SDMS ADMINISTRATIVE RECORD IMAGERY INSERT FORM

<b>SITE NAME</b>	PAGELS PIT		
<b>DOC ID #</b>	70622 / Page 17		
<b>DESCRIPTION OF ITEM(S)</b>	SITE LOCATION MAPS		
<b>REASON WHY UNSCANNABLE</b>	___ ILLEGIBLE	or	___ <u>X</u> FORMAT OVERSIZED
<b>DATE OF ITEM(S)</b>	11-21-1986		
<b>NO. OF ITEMS</b>	2		
<b>PHASE</b>	___ <u>X</u> Remedial Volume <u>4</u> of <u>9</u> ___ <u>X</u> Original Update # ___		
<b>O.U.</b>	01/LAGOON		
<b>FRC</b>	Box # <u>1</u> Folder # <u>4</u>		
<b>COMMENTS</b>			